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Use of Ganga Hospital Open Injury Severity Scoring for determination of salvage versus amputation in open type IIIB injuries of lower limbs in children—An analysis of 52 type IIIB open fractures

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ABSTRACT

Introduction and aims: Open injuries in children are rare compared to adults. In children with major open injuries, there is no specific scoring system to guide when to amputate or salvage the limb. The use of available adult scoring systems may lead to errors in management. The role of Ganga Hospital Open Injury Severity Scoring (GHOISS) for open injuries in adults is well established and its applicability for pediatric open injuries has not been studied. This study was done to analyse the usefulness of GHOISS in pediatric open injuries and to compare it with MESS(Mangled Extremity Severity Score).

Methods: All children (0–18 years) who were admitted with Open type IIIB injuries of lower limbs between January 2008 and March 2015 were included. MESS and GHOISS were calculated for all the patients. There were 50 children with 52 type IIIB Open injuries of which 39 had open tibial fractures and 13 had open femur fractures.

Results: Out of 52 type IIIB open injuries, 48 were salvaged and 4 were amputated. A MESS score of 7 and above had sensitivity of 25% for amputation while GHOISS of 17 and above was found to be more accurate for determining amputation with sensitivity of 75% and specificity of 93.75%.

Conclusion: GHOISS is a reliable predictor of injury severity in type IIIB open fractures in children and can be used as a guide for decision-making. The use of MESS score in children has a lower predictive value compared to GHOISS in deciding amputation versus salvage. A GHOISS of 17 or more has the highest sensitivity and specificity to predict amputation.

Introduction

Pediatric trauma is the leading cause of death and disability in children and open fractures account for 1.5–2.6% of all injuries in children [1–4]. But these injuries need to be managed efficiently as mismanagement can cause unnecessary amputations and lifelong morbidity. These injuries have a wide spectrum of presentation and their severity can range from easily treatable to barely salvageable. There are certain fundamental differences between the pediatric and adult bone. A child's periosteum is thicker and is more osteogenic compared to adults. Fracture remodeling in children occurs at a rapid pace which causes deformities to gradually decrease with time. The healing potential is more and infection rates are less compared to adults for the same severity of injury. Also, injuries around the physes can cause progressive deformities of the affected joints [5].

There is an existing controversy in using adult trauma scores to determine salvage versus amputation in pediatric population. The most commonly used score is the Mangled Extremity Severity Score(MESS). MESS includes four factors – 1) the incipient force of injury, 2) presence or absence of shock, 3) ischemia to the limb and 4) age of the patient. The score of six or less can be salvaged and a score of 7 or more is indicated for amputation [6–8]. However, Lin et al. [9] postulated that in children even patients with a MESS score of more than 7 can be salvaged and advocated to attempt salvage till MESS score of less than 10. Age less than 30 is grouped as a single category in MESS and hence does not carry any weightage in children and secondly hypotension is usually a late sign in children, which again can lead to a low score [10,11]. Also, in

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severe crush injuries with intact vascularity, MESS score can be low clouding the surgeon's judgment. Hence three of the four parameters used in MESS can give spuriously low values when used for open type IIIB injuries in children and can lead to errors in decision making. It may not divulge the true severity of injury to the limb which might push the surgeon towards unwarranted attempts at salvage.

The Ganga Hospital Open Injury Severity scoring was proposed by S Rajasekaran et al. for predicting salvage versus amputation in open type III B injuries and providing management guidelines depending on the total score [12,13]. The authors felt the need for this score due to the varied presentation of type III B injuries, lack of proper management guidelines and lack of a comprehensive scale to determine salvage versus amputation in severely injured limbs [14]. The score has very little interobserver and intraobserver variability and it provides specific guidelines to the user regarding the protocol to be followed depending on the total score. The use of GHOISS has so far been limited to only open type III A and IIIB fractures in adults and its use in children has not been studied yet [15]. There are no proper guidelines available in the literature, which could help the treating surgeon to decide on amputation versus salvage in open injuries in children. All the existing scoring systems have been described for adults and extrapolating the same to children is controversial. This study was done to assess the applicability of GHOISS in paediatric open injuries and to compare it with MESS in terms of predicting amputation and salvage.

Methods

After obtaining institutional review board clearance for this study, the hospital database was accessed to identify the study population. All children (0–18 years) who were admitted with Open Type IIIB injuries of lower limbs between January 2008 and March 2015 were included in the study. The raw data was collected from Casualty Medical Registers, Electronic Medical Registry and the Operation Theater Records. The raw data was screened for the following inclusion and exclusion criteria:

Inclusion criteria:

1. Open Type IIIB injury to the long bones of lower limbs.
2. Direct arrival to our institution, after the injury.
3. Age <18 years and open physis at the time of initial injury.

Exclusion criteria:

1. Initial primary care given elsewhere
2. All patients presenting more than 24 h from the time of injury

Fifty children with a total of 52 fractures who had Type IIIB open injuries formed the study cohort. Two of the 50 patients had both open tibia and open femur fractures. Of the 52 fractures, 39 were open tibial fractures and 13 were open femur fractures. There were four amputations in the study group. All of the four amputees were

Box 1. Ganga Hospital Open Injury Severity Scoring

Covering structures: Skin and Fascia	**Score**
Wounds without skin loss	
Not over the fracture	1
Exposing the fracture	2
Wounds with skin loss	
Not over the fracture	3
Over the fracture	4
Circumferential wound with skin loss	5
Skeletal Structures: bone and joints	
Transverse/oblique fracture/Butterfly fragment < 50% circumference	1
Large butterfly fragment > 50% circumference	2
Comminution/segmental fractures without bone loss	3
Bone loss < 4cm	4
Bone loss > 4cm	5
Functional tissues: musculotendinous (MT) and nerve units	
Partial injury to MT unit	1
Complete but repairable injury to MT units	2
Irreparable injury to MT units/partial loss of a compartment/ complete injury to posterior tibial nerve	3
Loss of one compartment of MT units	4
Loss of two or more compartments/subtotal amputation	5

Co-morbid conditions: add 2 points for each condition present

- Injury - debridement interval > 12 hours
- Sewage or organic contamination/farmyard injuries
- Age > 65 years
- Drug-dependent diabetes mellitus/cardiorespiratory diseases leading to increased anaesthetic risk
- Polytrauma involving chest or abdomen with injury severity score > 25/fat embolism
- Hypotension with systolic blood pressure < 90 mmHg at presentation
- Another major injury to the same limb/compartment syndrome

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